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Spectra of Southern Galaxies with Carnegie Image Tube

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During February 1967 a cascaded image tube on loan to me from the Carnegie Institution of Washington was installed in the Fast Spectrograph at the Newtonian focus of the Cordoba 61-inch reflector at Bosque Alegre, Argentina. It was used to observe galaxies from 26 Feb. to 4 Mar. and showed a large gain in speed over the f/0.5 semi-solid Schmidt used earlier with Eastman 103aF film in the spectrograph. Twenty-four spectra were obtained of 20 galaxies and 6 stars.

The image tube developed by Drs. Merle Tuve and W. Kent Ford, Jr. of DTM, Carnegie Institution requires 20,000 volts provided by a Varian-Mikros high-voltage supply powered by 110 volts AC. A 110-volt power supply (and new telescope controls) had been provided by the Smithsonian Astrophysical Observatory, and installed at Bosque Alegre in Aug. 1966. The Smithsonian also purchased an f/0.87 Super-Farron of 3.6-inch aperture to focus the spectrum on the photo-cathode of the RCA C33011 tube. This, the tube and an Elgeet f/1.2 transfer lens were mounted by Dr. Ford in a 6.5-inch cylinder (Fig. 1) containing alnico bar magnets that produce a uniform magnetic field of about 225 Gauss along the axis of the tube. It was estimated that external magnetic fields of 100 milli-Gauss would displace the focussed spectrum by about 10 microns.

The 90-mm aperture of the Super Farron lens is less than the 97 x 63 mm. beam from the plane grating in the Fast Spectrograph, causing a 0.85 reduction in speed. The equivalent focal length of the Super Farron lens is 78 mm (larger than that of the semi-solid Schmidt camera) resulting in a dispersion of 290 A/mm. (instead of 480 A/mm.) and a further 0.4 reduction in speed. Moreover, the transmission of the 7-component, glass Super-Farron lens is 80% for wavelengths greater than 5500 A and drops to zero at 3900 A. Nevertheless, the image intensification of the RCA C 33011 focussed on Eastman 103aO or IIaO plates results in a gain of 10 or more for wavelengths from 5500 A to 7500 A.

Photographic focus tests were made for the Elgeet lens (focussing the phosphor screen on the plate), the high voltage (19000 volts) focussing the RCA tube, and the spectrograph collimator focussing the spectrum on the photo cathode. Fig. 2 is a 2.5 x enlargement of plate IT-27 with such focus tests on the Neon spectrum showing that the best settings are: Elgeet 0.90, voltage 19000, collimator 25.7. A rough magnetic survey of the region near the dome opening (where the image tube would be during exposures) showed that the horizontal component of the magnetic field changed by 100 m G from one side of the opening to the other, but spectra taken with the tube in these two positions showed no discernible shift.

The following spectra of galaxies were obtained, several with strong moonlight superimposed. Figs. 3 and 4 are 2.5 x enlargements, each with he comparison spectrum. (Starting from the left (yellow), the 5577 A night-sky line is seen, then 5852 A Neon, closely packed Ne lines to 6717 A and wider spaced ones to 7550 A. Then the second-order blue-green spectrum, ending on the right with the strong 5852 A Neon line.)

Table 1.

Image-tube Spectra of Southern Galaxies, Cordoba, Aug. 1967

NGC	Mag	Type	Plate Nos.	Comparison Star BS No.	Comparison Star Type	Remarks
3783*	13m1	SBa	48	5288	K0 III	Em. line.
			58	4922	F2	Star underexp.
4373*A	12.3	E3S0	55	5089	G8 III	
4767,A	12.9	E5S0	60	5136	K0	Star under
4945*	9.5	SBc	71	6855	M1 III	Em
5064	13.1	Sb	58	4922	F2	Star under
5128	7.7	Ep	48			Under exp.
5139		Glob Clust	62	(6563	Plan Neb)	
5365,B	12.8	SBO	51	5580	F8	
			52	5580	F8	Star over exp.
5643	11.4	SBc	60	5698	F6	Em., Star under
5967	12.8	Sc	52	5580	F8	Star over
			58	4922	F2	Star under
6221	11.8	SBb	66			Em. lines
6758	12.8	E1	49	7674	F8	
			55	5089	G8 III	Both under exp
			71	6855	M1 III	
6368-70	12.3	E2Sa	72	7943	F1 V	
6984-2	13.3	SBcS	53	6635	K2	
			61	8368	F0 IV	
7064	12.9	SBc	63	7943	F1 V	Star under
7124	12.8	SBc	56	7674	F8	Both underexp.
7205	11.7	Sb	50			Fogged
7232	13.2	SBa	61	8368	F0 IV	Star overexp.
7410	11.8	SBO	47			

NGC	Mag	Type	Plates	Comp. Star	Type	Remarks
7412	12.0	SBb	56	8700	G3 IV	Star under
7421	12.8	SBa	59	6635	K2	
7496	12.1	SBb	73	8787	F6 IV	
IC						
3896	13.0	E$_1$SBc	72	7943	F1 V	
4662	12.0	Irr	71	6855	M1 III	Em lines
5150		Plan Neb	57			
5240	12.5	SBa	53	8611	F0	
5328	12.8	E5	73	8787	F6 IV	

* Repeats of 3 spectra obtained in Mar. 1967.
The 2 x 2-inch plates usually have 4 spectra on each.
"BS No." refers to Yale Bright Star Catalog.